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MEXICAN BANKING REGULATION: EVIDENCE OF THE APPROPRIATENESS OF GOVERNMENT INTERVENTION

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ABSTRACT

In this paper we investigate the validity of two assumptions frequently used to justify the transformation of the Mexican banking system through federal regulation. These assumptions are: (i) the alleged existence of economies of scale, and (ii) a homogeneous structure of the Mexican banking system. Econometric evidence from banking data over the period 1980 - 1982 suggests that neither of these assumptions are likely valid. The Mexican banking system is subject to constant rather than increasing returns to scale.

Mexican Banking Regulation: Evidence of the Appropriateness of Government Intervention

The Mexican commercial banking system has been reformed continuously in the last 15 years with banking authorities playing an important role shaping the sector. They acted on the belief that banks were subject to both scale and scope economies.

A major concern of regulators in Mexico has been to promote a banking sector that provides financial services at low operating costs. To accomplish this objective substantial reforms have been introduced into banking legislation since the early 1970's. Many of these modifications gave rise to changes in the structure of the banking system. Particularly influential were the decisions that reorganized the banking system from specialized into multiple-services banks, and the way financial intermediaries were allowed to deliver jointly an extended product line of financial services. These changes affected the number of banking institutions and the degree of institutional specialized allowed in the provision of banking services.

As a result, the number of banking institutions declined from more than 200 in 1970 to less than 20 in 1987. Two hundred and twenty-two specialized deposit institutions, namely 104 deposit banks, 25 hipotecaries (mortgage banks) and 93 financieras (industrial banks), evolved into a smaller number of large multiple service banks and eventually disappeared in the early 1980's. Many of the newly created multiple-service banks continued a process of mergers which reduced further the number of financial intermediaries in the market.

This paper presents evidence on the validity of two officially stated assumptions frequently used to justify the transformation of the Mexican banking system. These assumptions are: (i) the alleged existence of economies of scale, and (ii) the existence of scope economies in the production of banking services in Mexico. Perhaps the case of Mexico is one of the few examples where authorities acted explicitly on the belief that the banking industry was subject to increasing returns to scale and to economies of scope [see Mancera (1978), and Romero Kolbeck (1980)].

Duality and the Multiproduct Firm Model

Duality theory provides a method for estimating the relevant scale elasticities important for this study. The application of duality is very useful in obtaining information on the production function by means of the firms cost function C(Y,W) whose variables are a vector of outputs, Y, and a vector of input prices W. This cost function satisfies the following conditions:

(a) C(Y,W) is a positive real valued function, defined and finite for all finite $Y > 0$, $W > 0$,

(b) C(Y,W) is a nonincreasing left continuous function on Y and tends to plus infinity as Y tends to plus infinity for every $W > 0$,

(c) C(Y,W) is a nondecreasing function in W,

(d) C(Y,W) is linear homogeneous in W for every Y > 0, that is, for every scalar $\tau > 0$, Y > 0, W > 0, $C(Y;\tau W) = \tau C(Y,W)$,

(e) C(Y,W) is a concave function in W for every Y > 0,

when these conditons are met, the following results hold:

(i) each cost function determines an implicit production possibility set,

(ii) there is a one-to-one relationship between the production possibility set and the cost structure, and

(iii) the technology of the firm can be generated from the cost function.

The important implication of duality theory is that the technological constraints summarized in the production function can be represented equivalently under certain conditions by the cost function.

Research Strategy

In order to estimate a multiproduct cost function, the strategy adopted was to test the sensitivity of the parameters to the specification of functional form, output aggregation, output definition and structural change. First, this we investigated three flexible functional forms to test for functional form specification between the translog and the quadratic functions. Second, once the functional specification was chosen, we proceeded with the estimation of the cost function according to the specified model. Third, the study performs tests to detect problems of nonsperical disturbances and omission of variables. Fourth, tests for output aggregation were conducted to arrive at a parsimonious model. Fifth, we tested for structural change among banks and over time. Sixth, we calculated overall returns to scale, cost complementarities, marginal costs, and elasticities of substitution. Seventh, we assessed the sensitivity of the parameters of overall returns to scale to the definition of banking output.

Given the space limitations of this format we will present the results of this in-depth analysis by summarizing wherever we believe an adequate and well documented literature exists. This will allow an opportunity for presentation for the key economic measures and discussion of their economic implications.

Sample Data

The data used in this study comes from the National Banking Commission (Comisión Nacional Bancaria). The data consists of quarterly observation for 29 banks which operated from January 1980 through December 1982. Hence, the working sample has 348 observations. This sample of multiservice banks is very representative because the included banks represent more than 90% of the banking institutions which make up more than 98% of commercial banking operations in Mexico. Some caveats apply to the data set.

The data were obtained from public information and from confidential income statements of individual banks. The Boletín de Indicadores Financieros de Banca Múltiple, Privada y Mixta, and the Boletín de Indicadores Financieros de Banca Múltiple, are monthly publications of the Comisin Nacional Bancaria y de Seguros (CNBS), the banking and insurance regulatory agency. These public sources make available data on assets, liabilities and capital structure. The publicly available information includes the balance sheet, data on the gross structure of assets and liabilities, loan portfolio, deposit structure, capital structure, and profits for individual banks. Confidential information includes operating income and expenses for individual banks.

Assets comprise cash, government securities and required reserves, fixed income securities, stock or equity portfolio, loans outstanding, overdue loans (i.e. loans on which payments have not been met), other debtors to the bank, and misceallaneous assets.

The loan portfolio is broken down into categories such as discounts, loans with collateral, loans with industrial collateral, short-term and long- term loans, loans with real estate as collateral, total outstanding loan portfolio, overdue loan portfolio and rediscounted loans.

The data on liabilities and deposit structure cover checking and savings account deposits, time deposits, promises to pay, loans from other banks, other loans, other liabilities, total liabilities, paid equity, and undistributed profits. Confidential income-expense statements incorporate data on i) Operating Income [Interest, Dividends, Exchange-rate Fees and Commissions]; ii) Operating Expenses [Interest, Fees and Commissions, Exchange-rate (losses), Salaries and Employee Benefits, Fees to Members of the Board, Other Professional Fees, Rents, Promotional Expenses (Advertising), Depreciation, Amortization and Reserves, Taxes, Non-deductible expenses for income purposes, Other Operation and Administrative Expenses]; iii) Operating Profit, iv) Other Income and Recoveries; v) Other Expenses; vi) Profit before Income Tax and Profit Sharing; vii) Income Tax; viii) Profit Sharing; ix) Net Profit.

In view with the experience in banking studies and the availability of data, we adopted two proxies as measures of banking output that are similar to those used in Lamberte (1982), and Benston et. al. (1983). We also considered three alternatives as output bundles that reflect the services provided by banks. The first alternative uses monetary values for each bank output. The second two alternatives for defining bank output use number of accounts. {After extensive testing of output form we concluded that output measured in value as opposed to number of accounts represented the best proxy for banking output and only these results are reported in this paper}.

Each Q_i represents a banking output:

Q_6 = value of checking accounts,

Q_7 = value of savings accounts,

Q_A = value of time deposits and "pagares",

Q_9 = discounts and rediscounts,

Q_{10} = short-term loans,

Q_p = long-term loans and investment in securities.

Factor Prices

Two input prices are considered, one for labor and the other for the use of physical capital. The price of labor (P_L) is derived by dividing all labor expenses by the number of employees. Labor expenses include salaries and fringe benefits to all employees, consulting fees, vacation premium, sick leave, other short-term leave, health insurance, longevity payments, severance payments, and profit sharing.

The cost of physical capital (P_k) is approximated as the sum of major expenses such as building and equipment (including computers and peripherals) rent payments, depreciation, and utilities (electricity, phone services), divided by the average peso value of deposits and earning assets. P_k refers to a crude unit price of equipment and building services, similar to the one defined by Murray and White (1983).

Other Variables

Other variables possibly influence the banking industry cost function. We selected i) the number of branches associated with each bank (B), ii) the reserve requirement (ENC), and iii) a proxy measure of financial risk (R_3).

Branch numbers are included to capture the effect of branch expansion on operating costs. Branch expansion in the Mexican banking industry was a response to regulatory constraints on entry and interest rate ceilings on deposits. With a measure of branches we are able to estimate an "augmented scale economies" measure which adjusts the overall scale economies measure for the possible (diseconomies of adding additional branches to the primary financial institution.

Risk in the financial sense used here is defined as the ratio of allowance for doubtful loans plus default losses plus overdue loans to total loan portfolio.

Model Specification

For the analysis we considered three alternative functional forms consistently used in the literature. These are the translog, the quadratic, and the generalized Box-Cox. Due to space limitation we describe only the very general form of these models. The interested reader can consult any of the references given at the end of this paper for additional information on the specification of these functional forms. The general dual cost function can be expressed as:

$$(1.) \quad C(\delta) = \alpha_0 + \sum_m \alpha_i Y_i(\lambda) + \sum_n \beta_j P_j(\lambda) + 1/2 \sum_m \sum_m \alpha_{ij} Y_i(\lambda) Y_j(\lambda) + 1/2 \sum_n \sum_n \beta_{ij} P_i(\lambda) P_j(\lambda) + \sum_m \sum_n \gamma_{ij} Y_i(\lambda) P_j(\lambda) + \sum_m \kappa_{iB} Y_i(\lambda) B(\lambda) + R_3 + ENC + \epsilon$$

where C= operating costs, Y_i = ith output, P_j = price of the jth factor of production, and the other variables as as defined earlier. Equation (1) has both linear and quadratic terms with an arbitrary number of outputs (m) and inputs (n).

Equation (1) defines a general non-homothetic cost function. By imposing restrictions on the parameters it is possible to obtain homegeneity of any desired degree. Also by imposing restrictions on the parameters λ and δ in equation (1) it is possible derive the translog and quadratic forms as special cases [Applebaum]. The cost equation (1) was used as the general form along with the input factor share equations derived from Shepard's Lemma as the system of equations for parameter estimation. Overall returns to scale, cost complementarities, marginal costs and elasticities of factor substitution are derived from the estimates of the system.

Empirical Results

Before estimating the seemingly unrelated regression procedure subject to the input price homogeneity and symmetry restrictions, procedures were undertaken to correct for heteroscedasticity. The presence of nonspherical disturbances was indicated by applying the Breusch-Pagan and the Glesjer tests in the simple ordinary least squares estimation of the cost equation. The applied heteroscedastic error model to correct this undesired feature assumes that the variance of the dependence variable is proportional to a power of its expectation (Judge et. al. pp. 437-439). The resulting estimate used in an estimated generalized least squares estimator (EGLS) corrected adequately for the problem.

The test results for the choice of functional form are reported in table 1. This table contains the values of the log likelihood function and the test statistics, -2 log λ, obtained from the linear, translog, and generalized functional forms. Each of these cost functions was estimated under the input-price homogeneity restriction using four banking outputs, i.e. checking deposits, savings deposits, time deposits and earning assets. The grid search was first performed by increments of 0.01 and later by increments of 0.001.

Table 1: Test Statistics for Alternative Functional Form		
Functional Form	Value of the Log Likelihood	- 2 log θ
Quadratic	-1992.36	4,820.81
Translog	417.8854	0.3188
Generalized Box-Cox $\lambda = 0.002$	418.044	
Degrees of Freedom = 314 -2 log θ is the chi-square statistic. $X^2(2, 0.05) = 9.210$ $X^2(2, 0.01) = 5.991$		

The generalized functional form maximized the value of the log likelihood function at $\lambda = 0.002$. Using the likelihood ratio test, the two alternatives hypotheses, i.e. the translog and the quadratic function are compared against the null hypotheses represented by the generalized function $\lambda = 0.002$. The results point out that the translog functional form cannot be rejected by the data as being significantly different from the generalized functional form, at a level of significance of a = 0.01.

In addition to testing for nonspherical disturbances and appropriate functional form, we also tested for significant structural differences among banks in the sample and for evidence of structural shift over the studied time period. This was accomplished by application of recursive residuals [Johnston]. According to the results of this testing there were identified four clearly distinguishable groups of banks. In addition the results indicate a rejection of the assumption of no structural shift over this time period. We identify and estimate scale measures for these alternative banking groups and for five distinct time periods in the sample data.

Given these results the cost and share equation systems were estimated for the following separate subsets: i) the eights smallest banks, ii) the 21st to 11th largest banks, iii) the 10th to 3rd largest banks, and iv) the 7th to the largest bank. {the last category had to be expanded from two to seven banks to assure an adequate number of degrees of freedom}.

Based upon the results of this section, the assumption of a translog cost function for the bank substructures and time periods could not be rejected with the available data. Therefore, the translog specification was maintained as the functional form to approximate the cost function and its properties for the Mexican commercial banking system. While we would like to present the actual parameter estimates for these cost systems this requires too much space. Instead we have chosen to present and discuss the estimated scale measures derived from these estimates.

Economic Measures and Implications

Table 2 reports the estimates of overall returns to scale, with and without the effects of the branches, evaluated at the geometric means of the data. In this manner the estimated scale parameters can be compared among different group cost structures with the same output mix and output volume. These results suggest that parameter estimates for overall returns to scale for the banking system as a whole are relatively stable. The estimated values are not statistically different from one implying that the Mexican banking system is subject to constant returns to scale in the provision of banking services. The augmented returns to scale estimates for the subperiods indicate decreasing returns which tend to become greater with time. Branch expansion appears to increase the cost of financial intermediation and could be seen as a direct cost of government banking regulation.

The comparison of the scale measures indicate the the smaller banks exhibit constant returns to scale while the largest banks experience strong economies of scale. Diseconomies of scale for branch expansion are evident at all levels. Thus it appears that the imposed growth of branch banking has been very costly for financial intermediaries. Furthermore the level of these branch diseconomies has been growing over time.

Table 2: Estimated Measures of Overall and Branch Scale Economies: By size of Bank and Time Period.					
	All 29 Banks: 1980-82	8 Smallest Banks: 1980-82	11th to 21st Largest Banks: 1980-82	7 largest Banks: 1980-82	
Overall Economies of Scale	1.0746	1.055	1.125	0.314	
Branch Economies of Scale	1.16	1.348	1.829	2.443	
Estimated Overall and Branch Scale Economies by time period					
	All 29 Banks: 1st to 3rd qtr 1980	All 29 Banks: 4th qtr 1980 to 1st qtr 1981	All 29 Banks 2nd qtr 1981 to 4th qtr 1981	All 29 Banks: 1st & 2nd qtr 1982	All 29 Banks: 3rd qtr & 4th qtrs 1982
Overall Economies of Scale	1.216	1.094	0.978	1.137	1.033
Branch Economies of Scale	1.280	1.607	2.2955	2.281	5.210
All measures calculated at the geometric means of the sample data.					

Summary and Implications

This paper has addressed the issues of structural change, and economies of scale concerning the cost structure of commercial banking services in Mexico. The study was conducted by analyzing quarterly data from 1980 to 1982 for 29 commercial banks. These banks accounted for more than 97% of the total funds mobilized by the system in those years. Recursive residuals were estimated in order to determine structural change. This accounts for several cost structures which vary in scale and output mix. The estimation of the parameters for scale and scope economies were derived from a multiproduct cost function that considered the production of six traditional banking services. The modelling of banks as multiproduct firms was preferred because single aggregate-output models simply do not reflect reality. In addition, aggregating outputs tends to bias the results on returns to scale.

The findings indicate the following results. First, Mexican commercial banks operating from 1980 to 1982 differed considerably in their cost structure and thus in their technology. Cost structures among banks varied due to a difference product mix and scale of operation. Moreover, banking outputs among banks are not identical. Banks tend to differentiate their services. These differences grow out of serving different markets. The cost structure has also changed in time due to changes in both the microeconomic and macroeconomic environment. Mergers of several banks and branch expansion relate to the former for 1980 and 1981, while devaluation of the Mexican, peso, weakening growth and financial disintermediation reflect the latter environment.

Second, we did not find any evidence supporting the existence of scale economies, i.e. increasing returns to scale for the system as a whole. The cost structure for four different bank groupings by size indicate that the production of banking services in the early 1980s was characterized by constant returns to scale within each group.

Third, cost complementarities exist between several kinds of deposits and loans, between deposits, and between various kinds of loans. However, these cost complementarities do not exist for all the combinations of outputs considered in this study.

Fourth, decreasing returns to scale characterize the production of banking services when the number of branches are considered. The augmented measure for economies of scale points to statistically significant diseconomies.

The conclusion of this study is that we find little evidence to support the argument that economies of scale are central to banking concentration in Mexico. The banks are not homogeneous intermediaries. Five classes of banks were identified that vary in product mix and scale of operation. Designing policies on the assumption that all banks have similar cost functions and behave similarly can lead to socially undesired results.

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